No. 200400210

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Pioneer Hi-Bred International, Inc.

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSES, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

CORN, FIELD

'PH77N'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this third day of November, in the year two thousand and six.

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and date on all reproductions* — Form Approved - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER
Pioneer Hi-Bred International, Inc.

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME

3. VARIETY NAME
PH77N

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*
7301 NW 62nd Avenue
Johnston, IA 50131-0085

5. TELEPHONE *(include area code)*
515/270-4051

6. FAX *(include area code)*
515/253-2125

FOR OFFICIAL USE ONLY

PVPO NUMBER
200400210

FILING DATE
May 10, 2004

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*
Corporation

8. IF INCORPORATED, GIVE STATE OF INCORPORATION
IOWA

9. DATE OF INCORPORATION
March 5, 1999

FEES RECEIVED

FILING AND EXAMINATION FEES:
$ 3652.00
DATE 5/10/04

CERTIFICATION FEE:
$ 768.00
DATE 10/5/06

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*
Steven R. Anderson
Research and Product Development
P.O. Box 85
Johnston, IA 50131-0085

11. TELEPHONE (Include area code)
515/270-4051

12. FAX (Include area code)
515/253-2125

13. E-MAIL
steven.anderson@pioneer.com

14. CROP KIND *(Common Name)*
CORN

16. FAMILY NAME *(Botanical)*
Gramineae

15. GENUS AND SPECIES NAME OF CROP
Zea Mays

17. IS THE VARIETY A FIRST GENERATION HYBRID?
☐ YES X NO

18. DOES THE VARIETY CONTAIN ANY TRANSGENES? (***OPTIONAL***)
☐ YES X NO

IF SO, PLEASE GIVE THE ASSIGNED USDA-APHIS REFERENCE NUMBER FOR THE APPROVED PETITION TO DEREGULATE THE GENETICALLY MODIFIED PLANT FOR COMMERICALIZATION. _____

19. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions on reverse)

a. X Exhibit A. Origin and Breeding History of the Variety
b. X Exhibit B. Statement of Distinctness
c. X Exhibit C. Objective Description of Variety
d. ☐ Exhibit D. Additional Description of the Variety *(Optional)*
e. X Exhibit E. Statement of the Basis of the Owner's Ownership
f. X Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository)*
g. X Filing and Examination Fee ($3,652), made payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)*
☐ YES *(If "yes", answer items 21 and 22 below)* X NO *(If "no", go to item 23)*

21. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES?
☐ YES ☐ NO
IF YES, WHICH CLASSES? ☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

22. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
☐ YES ☐ NO
IF YES, SPECIFY THE NUMBER 1,2,3, etc. FOR EACH CLASS.
☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED
(If additional explanation is necessary, please use the space indicated on the reverse.)

23. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?
X YES ☐ NO
IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on reverse.)*

24. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?
☐ YES X NO
IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on reverse.)*

25. The owners declare that a viable sample of basic seed of the variety has been furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER		SIGNATURE OF OWNER	
		Steven R Anderson	
NAME *(Please print or type)*		NAME *(Please print or type)*	
		Steven R. Anderson	
CAPACITY OR TITLE	DATE	CAPACITY OR TITLE	DATE
		Research Scientist	5-7-2004

(See reverse for instructions and information collection burden statement)

INSTRUCTIONS

200400210

GENERAL: To be effectively filed with the Plant Variety Protection Office (PVPO), **ALL** of the following items must be **received** in the PVPO: (1) Completed application form signed by the owner; (2) completed exhibits A, B, C, E; (3) for a seed reproduced variety at least 2,500 viable untreated seeds, for a hybrid variety at least 2,500 untreated seeds of each line necessary to **reproduce** the variety, or for tuber reproduced varieties verification that a viable *(in the sense that it will reproduce an entire plant)* tissue culture will be deposited and maintained in an approved public repository; (4) check drawn on a U.S. bank for $3,652 ($432 filing fee and $3,220 examination fee), payable to "Treasurer of the United States" *(See Section 97.6 of the Regulations and Rules of Practice.)* Partial applications will be held in the PVPO for not more than 90 days, then returned to the applicant as unfiled. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA, Room 401, NAL Building, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. **DO NOT** use masking materials to make corrections. If a certificate is allowed, you will be requested to send a check payable to "Treasurer of the United States" in the amount of $432 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

Plant Variety Protection Office
Telephone: (301) 504-5518
FAX: (301) 504-5291
Homepage: http://www.ams.usda.gov/science/pvpo/pvp.htm

To avoid conflict with other variety names in use, the applicant must check the appropriate recognized authority and provide evidence that name has been cleared by the appropriate recognized authority before the Certificate of Protection is issued. For example, for agricultural and vegetable crops, contact: Seed Branch, AMS, USDA, 10301 Baltimore Avenue, Suite 401 NAL Building, Beltsville, MD 20705. Telephone: (301) 504-5682 http://www.ams.usda.gov/lsg/seed.htm.

ITEM

19a. Give:
(1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;
(2) the details of subsequent stages of selection and multiplication;
(3) evidence of uniformity and stability; and
(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified

19b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:

(1) identify these varieties and state all differences objectively;
(2) attach statistical data for characters expressed numerically and demonstrate that these are clear differences; and
(3) submit, if helpful, seed and plant specimens or photographs (prints) of seed and plant comparisons which clearly indicate distinctness.

19c. Exhibit C forms are available from the PVPO Office for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.

19d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant color, disease resistance, *etc.*

19e. Section 52(5) of the Act requires applicants to furnish a statement of the basis of the applicant's ownership. An Exhibit E form is available from the PVPO.

20. If "Yes" is specified *(seed of this variety be sold by variety name only, as a class of certified seed)*, the applicant **MAY NOT** reverse this affirmative decision after the variety has been sold and so labeled, the decision published, or the certificate issued. However, if "No" has been specified, the applicant may change the choice. *(See Regulations and Rules of Practice, Section 97.103).*

23. *See Sections 41, 42, and 43 of the Act and Section 97.5 of the regulations for eligibility requirements.*

24. *See Section 55 of the Act for instructions on claiming the benefit of an earlier filing date.*

22. CONTINUED FROM FRONT *(Please provide a statement as to the limitation and sequence of generations that may be certified.)*

23. CONTINUED FROM FRONT *(Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.)*

United States, Nov. 1, 2003; Canada, Nov. 1, 2003

24. CONTINUED FROM FRONT *(Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).)*

NOTES: It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment or owner's representative during the life of the application/certificate. The fees for filing a change of address; owner's representative; ownership or assignment; or any modification of owner's name is specified in Section 97.175 of the regulations. *(See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of the Regulations and Rules of Practice.)*

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0581-0055. The time required to complete this information collection is estimated to average 1.4 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, sexual orientation, marital or family status, political beliefs, parental status, or protected genetic information. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call 202-720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

Exhibit A. Origin and Breeding History

Pedigree: PHBF0/PHTD5)X74233X

Pioneer Line PH77N, *Zea mays L.*, a yellow endosperm corn inbred, was developed by Pioneer Hi-Bred International, Inc. from the single cross hybrid PHBF0 (Certificate No. 9500201) X PHTD5 (PVP Certificate No. 9400095) using the pedigree method of plant breeding. Selfing was practiced from the above hybrid for 6 generations using pedigree selection. During line development, crosses were made to inbred testers for the purpose of estimating the line's combining ability. Yield trials were grown at Moorhead, Minnesota as well as other Pioneer research locations. After initial testing, additional hybrid combinations have been evaluated and subsequent generations of the line have been grown and hand-pollinated with observations again made for uniformity.

Variety PH77N has shown uniformity and stability for all traits as described in Exhibit C - "Objective Description of Variety". It has been self-pollinated and ear-rowed 5 generations with careful attention paid to selection criteria and uniformity of plant type to assure genetic homozygousity and phenotypic stability. The line has been increased both by hand and in isolated fields with continued observations for uniformity and stability, and for 3 generations during the final stages of inbred development and seed multiplication. Very high standards for genetic purity have been established morphologically using field observations and electrophoretically using sound lab molecular marker methodology.

No variant traits have been observed or are expected in PH77N.

The criteria used in the selection of PH77N were yield, both per se and in hybrid combinations; late season plant health, grain quality, stalk lodging resistance, and kernel size, especially important in production. Other selection criteria include: ability to germinate in adverse conditions; disease and insect resistance; pollen yield and tassel size.

Exhibit A: Developmental history for PH77N

Season/Year Pedigree Grown	Inbreeding Level of Pedigree Grown
PHBF0 Summer 1993	F0
PHTD5 Summer 1993	F0
PHBF0/PHTD5 Winter 1993	F1
PHBF0/PHTD5)X Summer 1994	F2
PHBF0/PHTD5)X7 Summer 1995	F3
PHBF0/PHTD5)X74 Summer 1996	F4
PHBF0/PHTD5)X742 Summer 1997	F5
PHBF0/PHTD5)X7423 Winter 1997	F6
PHBF0/PHTD5)X74233 Summer 1998	F7
PHBF0/PHTD5)X74233X	F8 SEED

*PH77N was selfed and ear-rowed from F3 through F7 generation.
#Uniformity and stability were established from F6 through F8 generation and beyond when seed supplies were increased.

Exhibit B: Novelty Statement

Variety PH77N mostly resembles Pioneer Hi-Bred International, Inc. proprietary inbred line PHTD5 (PVP Certificate No. 9400095). Tables 1A and 1B show two sample t-tests on data collected primarily in Ankeny, Johnston, and Dallas Center, IA. The traits collectively show measurable differences between the two varieties.

Exhibit B: Novelty Statement

Variety PH77N has a longer tassel peduncle length (20.8 cm vs 17.2 cm) than variety PHTD5 (Table 1A, 1B).

Variety PH77N has a lower COMRST score (4.7 vs 6.2) than variety PHTD5 (Table 2A, 2B).

Definitions:

COMRST = COMMON RUST (*Puccinia sorghi*).
A 1 to 9 visual rating indicating the resistance to Common Rust. A higher score indicates a higher resistance.

Exhibit B: Novelty Statement Tables

Table 1A: Data from Ankeny, Johnston, and Dallas Center, IA broken out by year and across environments are supporting evidence for differences between PH77N and PHTD5. Each year varieties were grown in 3 locations that had different environmental conditions. Environments had different planting dates and were in different fields. A two-sample t-test was used to compare differences between means.

DataField	YEAR	VARIETY-1	VARIETY-2	Count-1	Count-2	Mean-1	Mean-2	Mean_Diff	StdDeviation-1	StdDeviation-2	StdError-1	StdError-2	DF_Pooled	t-Value_Pooled	Prob_(2-tail)_Pooled
tassel peduncle length (cm)	2000	PH77N	PHTD5	15	15	19.9	14.9	5.1	2.052	2.800	0.530	0.723	28	5.7	0.000
tassel peduncle length (cm)	2001	PH77N	PHTD5	15	15	20.8	18.7	2.1	4.974	3.035	1.284	0.784	28	1.4	0.180
tassel peduncle length (cm)	2002	PH77N	PHTD5	15	15	20.6	17.1	3.5	2.261	3.195	0.584	0.825	28	3.5	0.002
tassel peduncle length (cm)	2003	PH77N	PHTD5	15	15	21.7	18.3	3.5	3.788	2.154	0.978	0.556	28	3.1	0.005

2004021 10

Exhibit B. Novelty Statement Tables

Table 1B: Summary data from Ankeny, Johnston, and Dallas Center, IA across years and environments are supporting evidence for differences between PH77N and PHTD5. Environments had different planting dates and were in different fields. A two-sample t-test was used to compare differences between means.

DataField	VARIETY-1	VARIETY-2	Count-1	Count-2	Mean-1	Mean-2	Mean_Diff	StdDeviation-1	StdDeviation-2	StdError-1	StdError-2	DF_Pooled	t-Value_Pooled	Prob_(2-tail)_Pooled
tassel peduncle length (cm)	PH77N	PHTD5	60	60	20.8	17.2	3.5	3.451	3.137	0.446	0.405	118	5.9	0.000

Table 2A: Data from the area of adaptation of PH77N broken out by location are supporting evidence for differences between PH77N and PHTD5. Varieties were grown in different locations that had different environmental conditions. Environments had different planting dates and were in different fields. A two-sample t-test was used to compare differences between means.

Datafield	EXPT_YEAR	LOCATION SHORT_NAME	GE Name1	GE Name2	Mean1	Mean2	Diff	SD1	SD2	Tvalue	Prob
COMRST score ABS	2000	MIBNUR	PH77N	PHTD5	4	5	-1	.	.	.	.
COMRST score ABS	2000	MIY00A	PH77N	PHTD5	5	7	-2	.	.	.	.
COMRST score ABS	2000	MIY03C	PH77N	PHTD5	4	6	-2	.	.	.	.
COMRST score ABS	2000	QPBCO1	PH77N	PHTD5	4.5	5	-0.5	.	.	.	.
COMRST score ABS	2000	WLBIBS	PH77N	PHTD5	6	8	-2	.	.	.	.

2004002210

We are submitting lab SSR molecular marker data to further support our case for distinction. By looking at SSR marker data we can distinguish differences in genotype. Scoring of marker genotype is based on the size of the amplified fragment, which may be measured by the number of base pairs of the fragment. While variation in the primer used or in laboratory procedures can affect the reported number of base pairs, relative values should remain constant regardless of the specific primer or laboratory used. When comparing lines it is preferable if all SSR profiles are performed in the same lab. The SSR analyses reported herein were conducted in-house at Pioneer Hi-Bred.

A standard set of SSR markers were used to genetically profile the inbred PH77N and its most similar variety PHTD5. The genetic profile data showed that for PH77N, a large segment of the genome on chromosome 5 was inherited due to recombination from a variety other than the most similar variety PHTD5. This shows that these inbreds are genetically distinct and homozygous for this segment. The segment was over 304 cM long on the published IBM2 2004 Neighbors frame map (Figure 1). This segment contains at least 28 publicly listed genes indicating that this chromosome segment is of functional significance. However, this segment undoubtedly contains many other genes, as the maize genome has recently been reported to contain over 59,000 functional genes (http://www.eurekalert.org/pub_releases/2004-10/rtsu-rro101204.php). The total map distance for the IBM2 2004 Neighbors Frame map is 7444 cM. If maize genes were randomly distributed, this would result in approximately 8 genes per cM, and 2432 genes in this 304 cM segment. Composite public physical maps can be found at (http://www.maizegdb.org/). The public polymorphic markers that define this distinct segment are listed (Table 3).

Table 3. SSR Marker scores for PH77N and PHTD5 on chromosome 5

SSR Marker	Chromosome Number	Position IBM2 Neighbors Map	PH77N Base Pairs	PHTD5 Base Pairs
UMC1221	5	368.4	146	150.5
UMC1853	5	435.5	116	115
UMC2013	5	559.97	128.9	125.1
BNLG1711	5	666.54	178.9	176.9
UMC2308	5	672.6	132.7	131.9

Chromosome 5 comparison of PH77N with PHTD5

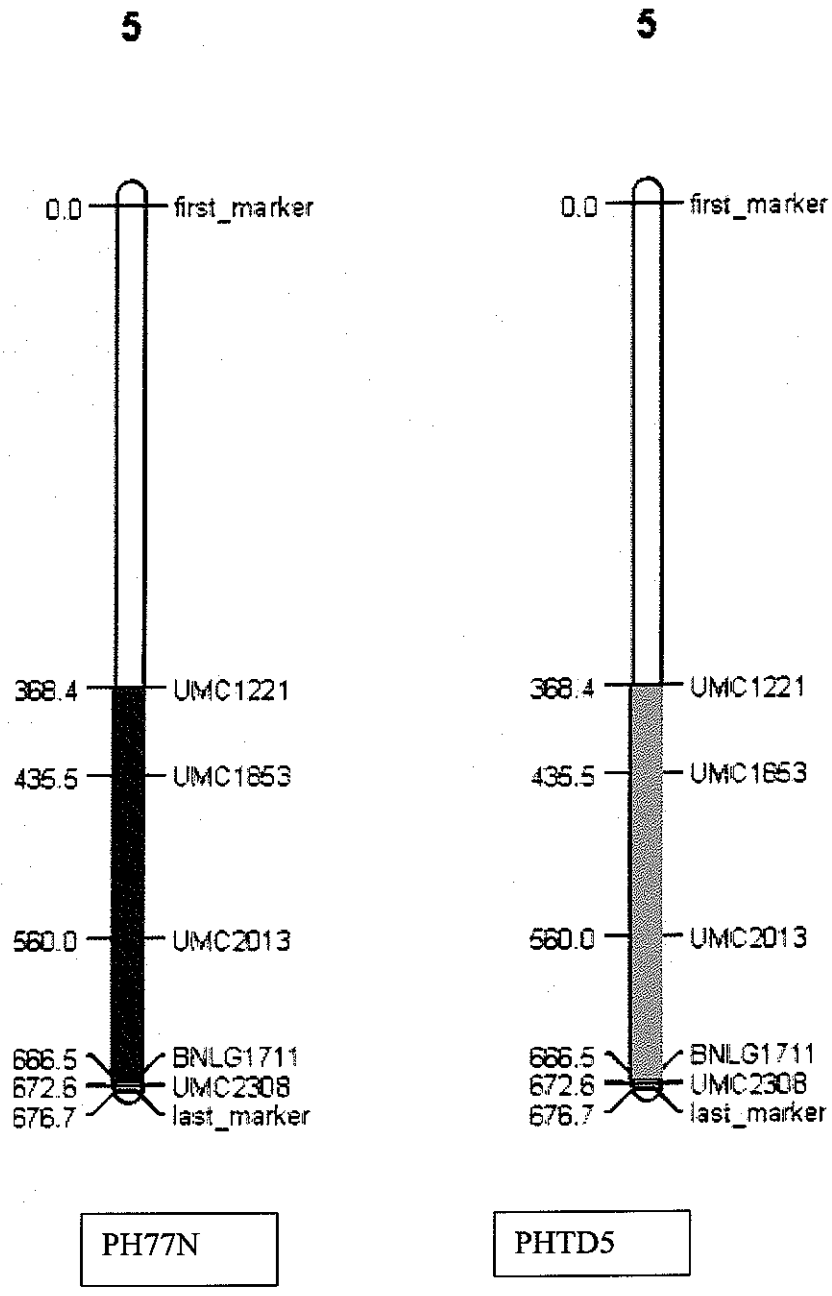

Figure 1. A polymorphic recombination segment on chromosome 5 shows a clear genetic difference between PH77N and the most similar line PH2VK.

Answers to PVP QA questions for accepting DNA fingerprinting differences:

1. The experimental design or procedures followed are published and cited;

Primers used for the SSRs reported are publicly available and may be found in the Maize GDB using the World Wide Web prefix followed by maizegdb.org (maintained by the USDA Agricultural Research Service), in Sharopova et al. (Plant Mol. Biol. 48(5-6):463-481), Lee et al. (Plant Mol. Biol. 48(5-6); 453-461), (http://www.maizegdb.org/).

The primers for these specific markers are listed:
UMC1221 http://www.maizegdb.org/cgi-bin/displaylocusrecord.cgi?id=242185
UMC1853 http://www.maizegdb.org/cgi-bin/displaylocusrecord.cgi?id=301599
UMC2013 http://www.maizegdb.org/cgi-bin/displaylocusrecord.cgi?id=302079
BNLG1711 http://www.maizegdb.org/cgi-bin/displaylocusrecord.cgi?id=144973
UMC2308 http://www.maizegdb.org/cgi-bin/displaylocusrecord.cgi?id=616331

2. The experimental design or procedures (or portions there of) can not be confidential;

The Peer reviewed methodology for SSR loci as molecular markers is cited below from this publication:
Smith et al (1997) An evaluation of the utility of SSR loci as molecular markers in maize (Zea mays L.): comparisons with data from RFLPs and pedigree. Theor Appl Genet 95: 163-173

3. The specific differentiating bands are cited;

Please refer to Table 3 and Figure 1

4. Photographic copies [of gels or other results] of scientific publishable quality with sufficient resolution and labeling to resolve the individual bands in question are provided;

We have included an example of the differentiating bands from the electropherogram for marker UMC2013 (Figure 2).

5. The procedure is well established and currently acceptable, or if novel, the results are from at least two independent laboratories with the experimental design appearing reliable.

See 1 and 2 above.

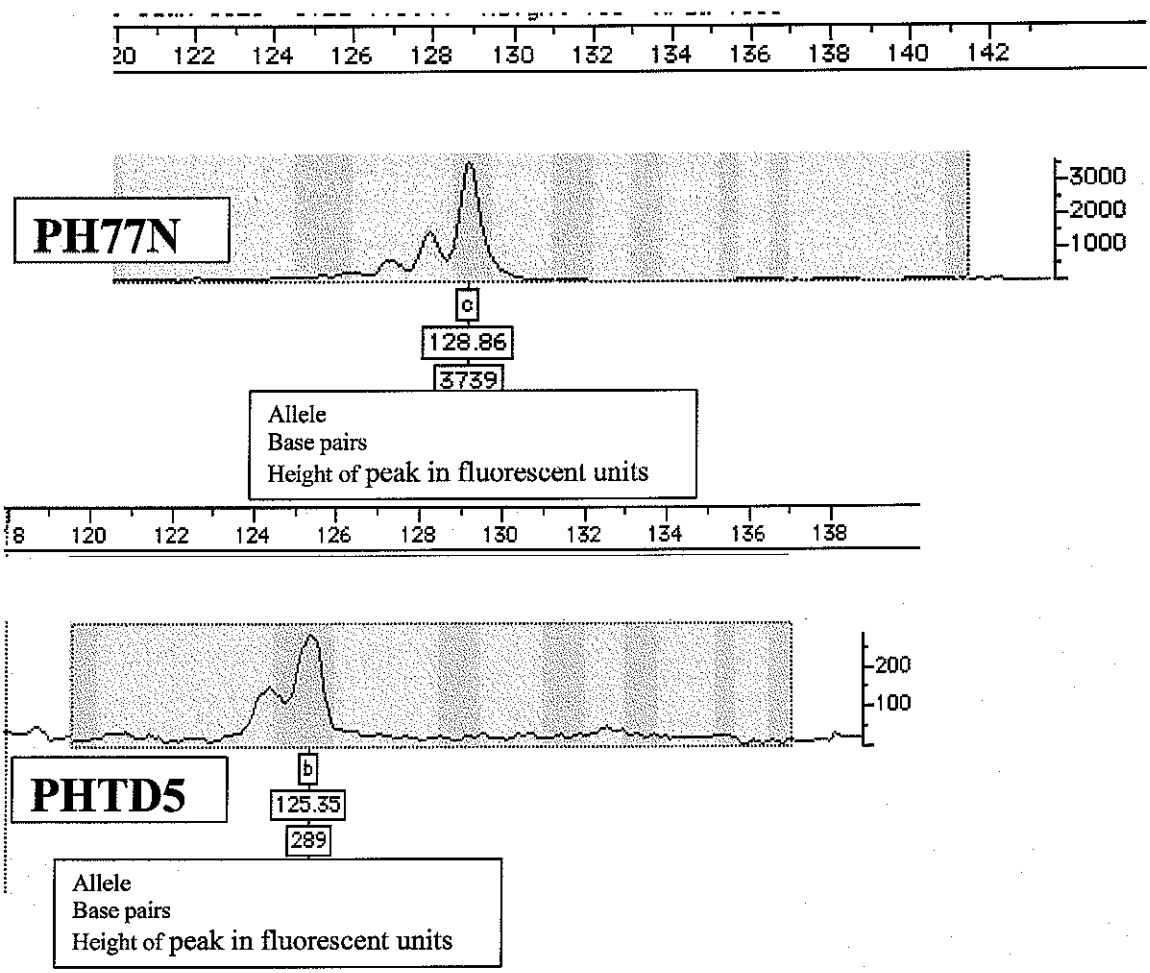

Figure 2 Electropherogram data for marker UMC2013

EXHIBIT C

(Corn; Maize)
United States Department of Agriculture, Agricultural Marketing Service

(8-22-2001)
Science and Technology, Plant Variety Protection Office
National Agricultural Library Building, Room 400
Beltsville, MD 20705-2351

OBJECTIVE DESCRIPTION OF VARIETY
CORN (Zea Mays L.)

Name of Applicant(s)	Variety Seed Source	Variety Name or Temporary Designation
Pioneer Hi-Bred International, Inc		**PH77N**

Address (Street & No., or R.F.D. No., City, State, Zip Code and Country)	**FOR OFFICIAL USE**	PVPO Number
7301 NW 62nd Avenue, P.O. Box 85, Johnston, Iowa 50131-0085		**200400210**

Place the appropriate number that describes the varietal characters typical of this inbred variety in the spaces below. Right justify whole numbers by adding leading zeroes if necessary. Completeness should be striven for to establish an adequate variety description. Traits designated by a "*" are considered necessary for an adequate variety description and must be completed.

COLOR CHOICES (Use in conjunction with Munsell color code to describe all color choices; describe #25 and #26 in Comments section):

01. Light Green	06. Pale Yellow	11. Pink	16. Pale Purple	21. Buff	26. Other (Describe)
02. Medium Green	07. Yellow	12. Light Red	17. Purple	22. Tan	
03. Dark Green	08. Yellow-Orange	13. Cherry Red	18. Colorless	23. Brown	
04. Very Dark Green	09. Salmon	14. Red	19. White	24. Bronze	
05. Green-Yellow	10. Pink-Orange	15. Red & White	20. White Capped	25. Variegated (Describe)	

STANDARD INBRED CHOICES [Use the most similar (in background and maturity) of these to make comparisons based on grow-out trial data]:

Yellow Dent Families:		Yellow Dent (Unrelated):	Sweet Corn:
Family	Members	Co109, ND246	C13, Iowa5125, P39, 2132
B14	CM105, A632, B64, B68	Oh7, T232	
B37	B37, B76, H84	W117, W153R	Popcorn:
B73	N192, A679, B73, Nc268	W182BN	SG1533, 4722, HP301, HP7211
C103	Mo17, Va102, Va35, A682		
Oh43	A619, MS71, H99, Va26	White Dent:	Pipecorn:
WF9	W64A, A554, A654, Pa91	CI66, H105, Ky228	Mo15W, Mo16W, Mo24W

1. TYPE: (describe intermediate types in comments section)	Standard Inbred Name	A554
2 (1=Sweet, 2=Dent, 3=Flint, 4=Flour, 5=Pop, 6=Ornamental, 7=Pipecorn)	2 Type	
Comments: Dent/Flint		

2. REGION WHERE DEVELOPED IN THE U.S.A.:	Standard Seed Source	AMES 19305
2 (1=N.West, 2=N.Central, 3=N.East, 4=S.East, 5=S.Central, 6=S.West, 7=Other	_ Region	

3. MATURITY (In Region Best Adaptability; show Heat Unit formula in "Comments" section):			DAYS	HEAT UNITS
DAYS	HEAT UNITS			
57	1,236.8	From emergence to 50% of plants in silk	56	1,208.9
57	1,228.9	From emergence to 50% of plants in pollen	56	1,205.0
3	59	From 10% to 90% pollen shed	2	58
___	____._	From 50% silk to optimum edible quality	___	____._
___	____._	From 50% silk to harvest at 25% moisture	___	____._

4. PLANT:	St.Dev.	Sample Size	Mean	St.Dev.	Sample Size
193.3 cm Plant Height (to tassel tip)	14.13	60	174.5	13.65	60
83.5 cm Ear Height (to base of top ear node)	15.06	60	59.8	9.84	60
15.1 cm Length of Top Ear Internode	1.84	60	13.0	1.92	60
0.0 Average Number of Tillers	0.04	12	0.0	0.02	12
1.1 Average Number of Ears per Stalk	0.13	12	1.0	0.11	12
3 Anthocyanin of Brace Roots: 1=Absent, 2=Faint, 3=Moderate, 4=Dark			3		

12

Application Variety Data	Page 2		Standard Inbred Data		
5. LEAF	**St.Dev.**	**Sample Size**	**Mean**	**St.Dev.**	**Sample Size**
8.5 cm Width of Ear Node Leaf	0.68	60	8.8	0.96	60
73.4 cm Length of Ear Node Leaf	4.45	60	67.8	5.14	60
4.9 Number of leaves above top ear	0.65	60	5.9	0.80	60
27.8 Degrees Leaf Angle	6.74	60	25.5	7.00	60
(Measure from 2nd leaf above ear at anthesis to stalk above leaf)					
4 Leaf Color (Munsell code) 7.5GY 3/4			3 (Munsell code) 5GY 4/4		
1 Leaf Sheath Pubescence (Rate on scale from 1=none to 9=like peach fuzz)			2		
__ Marginal Waves (Rate on scale from 1=none to 9=many)			____		
__ Longitudinal Creases (Rate on scale from 1=none to 9=many)			____		
6. TASSEL:	**St.Dev.**	**Sample Size**	**Mean**	**St.Dev.**	**Sample Size**
11.5 Number of Primary Lateral Branches	2.79	60	11.3	2.80	60
25.9 Branch Angle from Central Spike	11.71	60	22.6	10.18	60
52.8 cm tassel Length	5.03	60	48.6	4.49	60
(from top leaf collar to tassel tip)					
6 Pollen Shed (Rate on scale from 0=male sterile to 9=heavy shed)			6		
14 Anther Color (Munsel code) 10RP 4/6			5 (Munsell code) 5Y 8/8		
14 Glume Color (Munsell code) 2.5R 3/8			2 (Munsell code) 5GY 6/6		
1 Bar Glumes (Glume Bands): 1=Absent, 2=Present			1		
7a. EAR (Unhusked Data):					
14 Silk Color (3 days after emergence) (Munsell code) 7.5RP 3/8			12 Munsell code 10RP 5/6		
2 Fresh Husk Color (25 days after 50% silking) (Munsell code) 5GY 6/8			2 Munsell code 5GY 7/8		
19 Dry Husk Color (65 days after 50% silking) (Munsell code) 5Y 9/2			21 Munsell code 2.5Y 8.5/4		
2 Position of Ear at Dry Husk Stage: 1=Upright, 2=Horizontal, 3=Pendent			3		
5 Husk Tightness (Rate on scale from 1=very loose to 9=very tight			6		
2 Hush Extension (at harvest): 1=Short(ears exposed), 2=Medium (<8cm), 3=Long (8-10cm beyond ear tip), 4=Very Long (>10cm)			2		
7b. EAR (Husked Ear Data)	**St. Dev.**	**Sample Size**	**Mean**	**St.Dev.**	**Sample Size**
13.3 cm Ear Length	1.28	60	9.3	1.09	60
40.1 mm Ear Diameter at mid-point	2.18	60	38.2	2.68	60
91.3 gm Ear Weight	13.33	60	57.6	14.06	60
16.1 Number of Kernel Rows	1.16	60	13.9	1.10	60
2 Kernel Rows: 1=Indistinct, 2=Distinct			2		
2 Row Alignment: 1=Straight, 2=Slightly Curved, 3=Spiral			2		
12.3 cm Shank Length	3.60	60	8.7	3.64	60
2 Ear Taper: 1=Slight, 2=Average, 3=Extreme			2		
8. KERNEL (Dried):	**St.Dev.**	**Sample Size**	**Mean**	**St.Dev.**	**Sample Size**
9.9 mm Kernel Length	0.78	60	9.7	0.77	60
7.8 mm Kernel Width	0.72	60	7.5	0.62	60
5.2 mm Kernel Thickness	0.76	60	4.3	0.57	60
55.2 % Round Kernels (Shape Grade)	17.11	12	34.8	24.25	12
1 Aleurone Color Pattern: 1=Homozygous, 2=Segregating (Describe) _____			1		
7 Aleurone Color (Munsell code) 1.25Y 7/14			9 Munsell code 2.5YR 7/12		
7 Hard Endosperm Color (Munsell code) 10YR 6/10			7 Munsell code 10YR 7/12		
3 Endosperm Type: 1=Sweet(su1), 2=Extra Sweet(sh2), 3=Normal Starch, 4=High Amylose Starch, 5=Waxy Starch, 6=High Protein, 7=High Lysine, 8=Super Sweet (se), 9=High Oil, 10=Other_____			3		
23.3 gm Weight per 100 kernels (unsized sample)	1.23	12	18.3	3.02	12

Application Variety Data | Standard Inbred Data

Note: Use chart on first page to choose color codes for color traits

Application Variety Data	Page 3	Standard Inbred Data

9. COB:	St.Dev.	Sample Size	Mean	St.Dev	Sample Size
23.8 mm Cob Diameter at mid-point	1.61	60	21.9	1.80	60
12 Cob Color (Munsell code) 10R 4/6			10 Munsell code	10R 4/8	

10. DISEASE RESISTANCE (Rate from 1(most susceptible) to 9 (most resistant); leave blank if not tested; leave Race or Strain Options blank if polygenic):

A. Leaf Blights, Wilts, and Local Infection Diseases	
_ Anthracnose Leaf Blight (Colletotrichum graminicola)	_ Anthracnose Leaf Blight
Common Rust (Puccinia sorghi)	Common Rust
_ Common Smut (Ustilago maydis)	_ Common Smut
6 Eyespot (Kabatiella zeae)	3 Eyespot
Goss's Wilt (Clavibacter michiganense spp. nebraskense)	Goss's Wilt
5 Gray Leaf Spot (Cercospora zeae-maydis)	3 Gray Leaf Spot
_ Helminthosporium Leaf Spot (Bipolaris zeicola) Race_____	_ Helminthosporium Leaf Spot Race___
4 Northern Leaf Blight (Exserohilum turcicum) Race_____	5 Northern Leaf Blight Race___
Southern Leaf Blight (Bipolaris maydis) Race_____	Southern Leaf Blight Race___
5 Southern Rust (Puccinia Polysora)	4 Southern Rust
7 Stewart's Wilt (Erwinia stevartii)	7 Stewart's Wilt
_ Other (Specify)_____	_ Other (Specify)_____
B. Systemic Diseases	
Corn Lethal Necrosis (MCMV and MDMV)	Corn Lethal Necrosis
9 Head Smut (Sphacelotheca reiliana)	9 Head Smut
_ Maize Chlorotic Dwarf Virus (MCDV)	_ Maize Chlorotic Dwarf Virus
_ Maize Chlorotic Mottle Virus (MCMV)	_ Maize Chloritic Mottle Virus
Maize Dwarf Mosaic Virus (MDMV) Strain_____	Maize Dwarf Mosaic Virus Strain___
_ Sorghum Downy Mildew of Corn (Peronosclerospora sorghi)	_ Sorghum Downy Mildew of Corn
_ Other (Specify)_____	_ Other (Specify)_____
C. Stalk Rots	
8 Anthracnose Stalk Rot (Colletotrichum graminicola)	4 Anthracnose Stalk Rot
Diplodia Stalk Rot (Stenocarpella maydis)	Diplodia Stalk Rot
Fusarium Stalk Rot (Fusarium moniliforme)	Fusarium Stalk Rot
Gibberella Stalk Rot (Gibberella zeae)	Gibberella Stalk Rot
_ Other (Specify)_____	_ Other (Specify)_____
D. Ear and Kernel Rots	
_ Aspergillus Ear and Kernel Rot (Aspergillus flavus)	_ Aspergillus Ear & Kernel Rot
_ Diplodia Ear Rot (Stenocarpella maydis)	_ Diplodia Ear Rot
7 Fusarim Ear and Kernel Rot (Fusarium moniliforme)	7 Fusarium Ear & Kernel Rot
6 Gibberella Ear Rot (Gibberella zeae)	6 Gibberella Ear Rot
_ Other (Specify)_____	Other (Specify)_____

Application Variety Data Page 3 Standard Inbred Data

Note: Use chart on first page to choose color codes for color traits.

Application Variety Data	Page 4		Standard Inbred Data		
11. INSECT RESISTANCE (Rate from 1(most susceptible) to 9 (most resistant); Leave blank if not tested	St. Dev.	Sample Size		St. Dev.	Sample Size
_ Banks Grass Mite (Oligonychus pratensis)			_ Banks Grass Mite		
Corn Earworm (Helicoverpa zea)			Corn Earworm		
_ Leaf Feeding			_ Leaf Feeding		
Silk Feeding ___._mg larval wt.	_____	_____	___._	_____	_____
_ Ear Damage			_ Ear Damage		
_ Corn Leaf Aphid (Rhopalosiphum maidis)			_ Corn Leaf Aphid		
_ Corn Sap Beetle (Carpophilus dimidiatus)			_ Corn Sap Beetle		
European Corn Borer (Ostrinia nubilalis)			European Corn Borer		
4 1 st Generation (Typically Whorl Leaf Feeding)			4 1 st Generation		
_ 2 nd Generarion (Typically Leaf Sheath-Collar Feeding)			_ 2 nd Generation		
Stalk Tunneling: ___._cm tunneled/plant	_____	_____	___._	_____	_____
Fall Armyworm (Spodoptera frugiperda)			Fall Armyworm		
_ Leaf-Feeding			_ Leaf-Feeding		
Silk-Feeding ___._mg larval wt.	_____	_____	___._	_____	_____
_ Maize Weevil (Sitophilus Zeamaize)			_ Maize Weevil		
_ Southern Rotworm (Diabrotica undecimpunctata)			_ Southern Rootworm		
Southwestern Corn Borer (Diatraea grandiosella)			Southwestern Corn Borer		
_ Leaf Feeding			_ Leaf Feeding		
Stalk Tunneling: ___._cm tunneled/plant	_____	_____	___._	_____	_____
_ Two-spotted Spider Mite (Tetranychus urticae)			_ Two-spotted Spider Mite		
_ Western Rootworm (Diabrotica virgifera virgifera)			_ Western Rootworm		
_ Other (Specify)_____			_ Other (Specify)_____		
12. AGRONOMIC TRAITS:					
2 Stay Green (at 65 days after anthesis) (Rate on scale from 1=worst to 9=exellent)			2 Stay Green		
% Dropped Ears (at 65 days after anthesis)			% Dropped Ears		
% Pre-anthesis Brittle Snapping			% Pre-anthesis Brittle Snapping		
% Pre-anthesis Root Lodging			% Pre-anthesis Root Lodging		
Post-anthesis Root Lodging			Post-anthesis Root Lodging		
5,140.0 kg/ha Yield of Inbred per se (at 12-13% grain moisture)			2,404.0 Yield		

13. MOLECULAR MARKERS: (0=data unavailable; 1=data available but not supplied; 2=data supplied.)

1 Isozymes _ RFLP's _ RAPD's _ Other (Specify)_____

REFERENCES:

Butler, D.R. 1954. A System for the Classification of Corn Inbred Lines. PhD Thesis, Ohio University.
Emerson, R.A., G.W. Beadle, and A.C. Fraser, 1935. A summary of Linkage Studies in Maize. Cornell A.E.S., Mem. 180.
Farr, D.F., G.F. Bills, G.P. Chamuris, A.Y. Rossman. 1989. Fungi on Plant Products in the United States. The American Phytopathological Society, St. Paul, MN.

Inglett, G.E. (Ed) 1970. Corn: Culture, Processing, Products. Avi Publishing Company, Westpoint, CT.
Jugenheimer, R.W. 1976. Corn: Improvement, Seed Production, and Uses. John Wiley & Sons, New York.
McGee, D.C. 1988. Maize Diseases. APS Press, St. Paul, MN. 150 pp.
Munsell Color Chart for Plant Tissues. Macbeth. P.O. Box 230. Newburgh, N.Y. 12551-0230
The Mutants of Maize. 1968. Crop Science Society of America. Madison, WI.
Shurtleff, M.C. 1980. Compendium of Corn Diseases. APS Press, St. Paul, MN. 105 pp.
Sprague, G.F., and J.W. Dudley (Editors). 1988. Corn and Corn Improvement, Third Edition. Agronomy Monograph 18. ASA, CSSA, SSSA, Madison, WI.

Stringfield, G.H. Maize Inbred Lines of Ohio A.E.S., Bul. 831. 1959.
U.S. Department of Agriculture 1936, 1937. Yearbook.

COMMENTS (e. g. state how heat units were calculated, standard inbred seed source, and/or where data was collected. Continue in Exhibit D)

Insect, disease, brittle snapping and root lodging data are collected mainly from environment where variability for the trait can be obtained within the experiment.

Our experimental design was set up in a typical complete block design commonly used in agricultural corn research experiments using three locations/environments. One replication was grown at each location. This is one more environment than is required according to the PVP application instructions. Our approach was to test the variety in more than 1 location (as instructed) while also allowing us the extra location/environment if there should be an unexpected failure at a location due to weather or other problems. There may also be situations where an additional year of testing was conducted resulting in 2 years of trial data. There would likely be more variability due to soil type differences, nutrients, or weather typical of different testing environments than if all three trials were grown in the same field on the same farm with the same planting dates in the same year. If you recommend that all locations/environments are grown in the same field with the same planting dates and same year, please let us know and we will adjust our 2007 procedures.

The experimental design and methods for 2003 were as follows:

Please update the exhibit C addendum with this paragraph:

The experiment procedures involved three environments with different planting dates, planted in 17.42 ft. rows with 2 rows for each variety. Approximately 24-30 plants emerged in each of 2 rows for a total of around 48 to 60 plants being evaluated at each location and 144 to 180 plants across locations. For plant level traits, we sampled 5 representative plants from the 2 rows of the 2 row plot (group) of plants at each location. For plot level traits we evaluated the 2 row plot (group) and gave a representative score or average on the 48-60 plants in the group within an experiment.

Some traits can be especially variable under different environmental factors influenced by weather, soil type, or planting dates. Varying temperatures or day length could impact the meristem growth during various tissue differentiation stages. The meristem differentiation of the ear and other tissues could be impacted as well as the success of pollination during flowering and frequency of kernel abortion during grain fill. Such variation could impact some of the traits that you mention because our experiment design does not grow all of the trials in the same field with the same planting date.

I would be happy to share detailed protocols or discuss with you in more detail the sampling, experiment design, reporting, and the conscientious evaluations that went into the characterization of the data..

CLARIFICATION OF DATA IN EXHIBITS B AND C

200400210

Please note the data presented in Exhibit B and C, "Objective Description of Variety," were collected primarily at Ankeny and Johnston, IA in 2000 and Dallas Center and Johnston, IA in 2001, 2002, and 2003. The data in Tables 1A and 1B are from two sample t-tests using data collected in Ankeny, Johnston, and Dallas Center, IA. These traits in exhibit B collectively show distinct differences between the two varieties.

REPRODUCE LOCALLY. Include form number and edition date on all reproductions. FORM APPROVED - OMB NO. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). The information is held confidential until the certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S)	2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER	3. VARIETY NAME
PIONEER HI-BRED INTERNATIONAL, INC.		**PH77N**

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP, and Country)*	5. TELEPHONE *(include area code)*	6. FAX *(include area code)*
7301 NW 62nd AVENUE P.O.BOX 85 JOHNSTON, IA 50131-0085	**515-270-4051**	**515-253-2125**

7. PVPO NUMBER **200400210**

8. Does the applicant own all rights to the variety? *Mark an "X" in the appropriate block.* **If no, please explain:** ☒ YES ☐ NO

9. Is the applicant (individual or company) a U.S. national or a U.S. based company? **If no, give name of country** ☒ YES ☐ NO

10. Is the applicant the original owner? ☒ YES ☐ NO **If no, please answer one of the following:**

a. If the original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. National(s)?

☐ YES ☐ NO **if no, give name of country**

b. If the original rights to variety were owned by a company(ies), is (are) the original owner(s) a U.S. based company?

☒ YES ☐ NO **If no, give name of country**

11. Additional explanation on ownership (Trace ownership from original breeder to current owner. Use the reverse for extra space if needed):

Pioneer Hi-Bred International, Inc. (PHI), Des Moines, Iowa, and/or its wholly owned subsidiary Pioneer Overseas Corporation (POC), Des Moines, Iowa, is the employer of the plant breeders involved in the selection and development of PH77N. Pioneer Hi-Bred International and/or Pioneer Overseas Corporation has the sole rights and ownership of PH77N pursuant to written contracts that assign all rights in the variety to PHI and/or POC at the time such variety was created. No rights to this variety are retained by any individuals.

PLEASE NOTE:

Plant variety protection can only be afforded to the owners (not licensees) who meet the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.

2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.

3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed the final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definitions.

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0581-0055. The time required to complete this information collection is estimated to average 0.1 hour per response, including the time for reviewing the instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, sexual orientation, marital or family status, political beliefs, parental status, or protected genetic information. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, D.C. 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal employment opportunity provide and employer.